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MICROCOMPUTERS ON THE FARM: HAS THEIR TIME COME?

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It may well be that the next explosion of technology to affect the American farm will be the microcomputer. Some foresee its impact equalling that of the farm tractor in the 1930s. Others say the well-managed farm, even today, cannot afford to be without one, and that by 1990 microcomputers in the farm office will be as common as the coffeepot in the kitchen. If so, "change" will again challenge every farmer, now and in the future.

It is not difficult to answer the question "Why?" The microcomputer has the potential of relieving the tediousness of record keeping and making it a more enjoyable task. It can reduce the time and effort involved in making farm decisions and formalize economic analysis that heretofore may have been done without even a pencil. The microcomputer can assist managers by reducing their time in "watching" or monitoring many of the mechanical, electrical, and biological operations and economic aspects of the farm business.

The optimism of the farm community about microcomputers is well deserved. They could be the greatest thing ever. However, they might also be the most troublesome technology yet. Whatever the case, farmers must investigate the challenges, costs, and benefits before investing in a microcomputer. The costs appear

small relative to promised results. Both, however, are nebulous, elusive, and deceptive. The feasibility and use of micro-computers on the farm is a very difficult question.

Computer prices have dropped to the point where many farmers can afford one. It is nearly impossible to read a farm magazine and not encounter an article or advertisement enticing the reader to purchase a computer for the farm business. Some farmers, not a large percentage (estimated at about one percent), have purchased a computer. It is only a small number of these, however, that are using the machine effectively. To most people, not just farmers, the computer remains a mystery. Farmers are accustomed to being able to determine how a machine operates. The inability to "figure out" how a computer works creates frustration that makes their decision "to buy or not to buy" very difficult. Once a farmer has made it through the agonizing process of deciding that he/she can no longer get along without that wonder of technology that "will make life easier," it is only human to rush out and bring the new "baby" home. Then comes the second decision, "Which microcomputer should I buy?" Rest assured that the microcomputer is a useful tool on some farms and will be on many more. Each purchaser must, however, de-mystify the machine and learn that, "Which machine" is the wrong question to ask.

REMOVING THE MYSTERY

The mystery surrounding microcomputers is to be expected but not necessary. After all, most everyone has been using the simplest of computers, the calculator, for some time; the primary difference being that the calculator only uses numbers and seemingly does not need instruction to perform its task. The microcomputer, on the other hand, can also use the alphabet and needs instructions from the operator. Remember it can do nothing people cannot do and can only do what it is instructed to do, but it can do it faster and if properly instructed, with fewer errors. In the same vein, if mis-instructed, it will make and compound more errors in a few seconds than a person could in a lifetime. De-mystification requires an understanding of the major components of a microcomputer (hardware), what makes it do what it does (software), and some knowledge of computer language and jargon.

HARDWARE

The hardware is the microcomputer itself. It is the hard or physical material that you can see and touch. The hardware cannot do anything by itself. The various hardware packages available consist of the same four components--an input device, a central processing unit, a storage unit, and an output device.

HARDWARE COMPONENTS

The input device (KEYBOARD) allows the user to communicate his/her thoughts to the microcomputer. It is typically a typewriter-like keyboard. The central processing unit (CPU) is

the electronic marvel that does all the arithmetic. It is the core of every microcomputer. The storage unit (MEMORY), as one might expect, enables the microcomputer to remember information entered or calculated. There are two classes of memory associated with microcomputers: primary and secondary. Primary memory is a part of the microcomputer and consists of two types: ROM (read-only memory) and RAM (random access memory). The user normally does not have access and therefore is little concerned about ROM. RAM memory is used to store instructions or data and is of great concern to the user. RAM capacity will determine if the machine is large enough for the task at hand. Information in RAM is lost when the electricity is turned off; not so with ROM. Secondary memory or storage is used to store whatever is in RAM memory that the user wants "remembered" when the electricity is turned off. The secondary storage will generally consist of magnetic "floppy" and/or "hard" disks. The output device permits the microcomputer to communicate to the user. Information is relayed from the microcomputer to the user by writing on a CRT (cathode ray tube), a device that looks like a television screen. The CRT provides a temporary visual (soft) record of output. For a permanent visual (hard) record of output, a printer will be needed and is identified as part of the hardware. The microcomputer system may also include communications hardware and/or software, referred to as a "modem." This device sends and receives signals and permits the microcomputer to communicate with another computer through a telephone. Hardware will vary considerably in size, shape, type, capacity, and compatibility.

Microcomputer hardware is fascinating but it is secondary in importance when considering the purchase of a machine. "Software, not hardware, is the name of the game."

SOFTWARE

Microcomputers will not function without software. Often referred to as computer programs or models, software packages operate the physical devices (hardware) and tell the computer how to perform each of its tasks. Computers are just the opposite of being intelligent, they must be told what to do at all times. This is the purpose of software. Every microcomputer requires a unique software package for each job it is expected to perform.

TYPES OF SOFTWARE

There are three general types of software associated with a microcomputer: operations, language interpreter (compiler), and application software. The operational software acts as central command, deciding what parts of the computer are to do what and when, and is usually purchased with the hardware package. This software is part of ROM memory and cannot be modified by the user. It is this software that unfortunately makes each brand of microcomputer different from all others. The computer language interpreter or compiler translates the software written in a language understandable to the user to another language understood by the computer. We humans, U.S. citizens anyway, have generally been taught two languages, English and decimal mathematics. The computer only understand one language, binary mathematics. Every software command given the microcomputer,

using our alphabet or number system, must be converted to a series of ones and zeros before it can be understood; this is the sole purpose of the compiler software. All other software packages are classified as application software. There are as many varieties of this software as there are user-languages times the number of applications times the number of programmers; a big number. Needless to say, good application software is central to implementing a microcomputer successfully. It is fair to estimate that 95 percent of the problems encountered with microcomputers occur with applications software. Its importance cannot be overestimated. The person preparing good applications software for farms is unique and difficult to find. He/she must know how to program a computer, understand the computer which will run the software, and most importantly, be knowledgeable about the area of application. Failure of the programmer to be proficient in all three areas has been, for the most part, overlooked by the majority of farmer computer enthusiasts, and has been the origin of most of the problems encountered.

OBTAINING GOOD SOFTWARE

The most important part of a microcomputer system is software. Thus the most important question a prospective buyer can ask is, "What software do you have that can help solve my problem?" rather than, "What hardware should I buy?" The availability of good software will dictate which hardware should be purchased. Good application software can be obtained in three ways. Contracting for or purchasing a custom designed software

package is likely to save time and effort in terms of getting a microcomputer operational. The programmer and farmer will generally work together in designing the software. It is important not to overlook the time commitment of the farmer in this process. Acquiring programs in this manner generally requires a large dollar outlay. A farmer might also find already-packaged programs that may fit his/her farm reasonably well and use them "as is" or modify them to correct apparent deficiencies. Using this method one must be careful that the program will work on his/her machine, will do the job desired, is properly documented, and that help is available to learn how to use it. A farmer with sufficient time, a desire, and some expertise can develop software. A great number of self-help programming books are available. Using this method the farmer can be sure the programmer understands the application, the most often missing element in a good software development. One should, however, disregard the statements of salespeople concerning the ease of learning about programming and machines and recognize this method requires a time commitment that most farmers do not have.

COMPUTER USER LANGUAGES

Recall the earlier discussion about the role of the language interpreter (compiler) that changes the user language (letters and numbers) to machine language (ones and zeros). There are numerous user languages, ranging from the very complex to the very simple (almost plain English). Each hardware manufacturer

specifies the user language(s) for this machine. It is important to remember the same user language is probably different for different hardware, much like the English language is different in London, New York, Columbus, and Atlanta. These differences are not big but they are significant to the point of rendering software useless unless modified to fit a particular machine. The most common microcomputer language is BASIC, an acronym for Beginners All-Purpose Symbolic Instruction Code. It is one of the simpler and more easily learned user-languages. The important thing to remember is that BASIC is BASIC so long as you are talking about the same microcomputer. Other more sophisticated and powerful languages such as FORTRAN, COBOL, and PASCAL are available but are generally more difficult to learn and are less user friendly.

PURCHASING HARDWARE/SOFTWARE SYSTEMS

You have decided to buy a microcomputer. STOP! RESET! RETURN TO SQUARE ONE! Suppress that urge and recheck your goals, your jobs, software requirements, software capabilities, and your costs in terms of dollars and time. Notice the apparent lack of concern about hardware. To be sure there are differences in hardware but they pale in light of the importance of your goals, jobs, and software. Unfortunately, most people still view a microcomputer as a goal or an end in itself. That it is not. It is instead the means of accomplishing a given set of goals and tasks more rapidly and more efficiently.

The farmer realizing that a computer will be useful in the business, faces so many alternatives that the "best" hardware/software decision remains elusive even after careful consideration. Manufacturers have entered the market with a variety of hardware/software packages. This variety is in response to objectives of users. Some farmers may only want a machine for family recreation, others want to add family education, others only want to keep track of cows, while others want a cash records, farm business analysis, and/or income tax forms filled out with a host of other tasks to be completed. The initial purchase is likely to be made with one or two objectives in mind. Once the farmer becomes familiar with the machine he/she will decide it can be used to do several additional tasks. This then speaks for a flexible and expandable system.

QUESTIONS AND JOBS

Before purchasing any microcomputer, analyze your business and family problems and identify the most likely use. Answer the following questions: (1) What are our problems? (2) What are our needs? (3) Where will the microcomputer pay off? and (4) What are other uses? Put together: (1) a set of current records, (2) information needed for day-to-day and now-and-then decisions, and (3) a descriptive list of tasks. Having answers to these questions and providing this information will aid the seller and purchases in identifying a satisfactory hardware/software package.

HARDWARE ALTERNATIVES AND GUIDELINES

Every hardware purchase should be preceded by visits to farmers who have purchased a similar system, to check out their experience and satisfaction. It will generally be more advantageous to purchase all hardware from the same vendor to reduce the incidence of "the problem is the fault of the other vendor's equipment" situations. Buy from a local, interested, and reputable vendor and manufacturer with a history of community service. There are many vendors of the "here today and gone tomorrow" type that ought to be avoided like the plague.

A minimum configuration for a farm system would include the following:

1. A typewriter-type keyboard for data entry and a CRT video display. Avoid units with punch cards and magnetic or paper tapes. The CRT should display at least 80 characters wide and 24 double spaced lines. An amber or green phosphor screen in preferable to white for most users.
2. The CPU (central processing unit) should be capable of handling current and future needs (software and hardware). The operation software should run a disk system and be MS-DOS or CP/M compatible. It should have a BASIC compiler with the ability to change to other languages if needed. The CPU should have at least 256K of bytes RAM memory. Eight bit bytes are most common but 16 and 32 bit bytes are becoming available and are preferable.

3. Dual (2) disk drives (one for programs and one for data) are preferable and the capability to add a hard disk is important.
4. A printer capable of printing both upper and lower case characters. A highly reliable printer is a must. It is mechanical and will likely be more troublesome than the microcomputer itself.
5. A modem (telephone hook-up) is a must. This will increase the usefulness of the microcomputer by allowing the farmer access to bigger computers, current market information, and other interesting programs and information.

Hardware with these specifications may go beyond the initial needs. However, farmers purchasing less will be making the same mistake they or their neighbors made by purchasing a 75 horsepower tractor when they should have purchased one with 150 horsepower. The above hardware will likely cost between $3,000 and $10,000.

SOFTWARE ALTERNATIVES AND GUIDELINES

As indicated in earlier discussion, software decisions are much more difficult and important than hardware decisions. The microcomputer is no better than its software. Salespeople and advertisements lure the unsuspecting buyer into thinking that the machine will very easily accomplish the jobs a person needs done. They infer that new owners can with ease write their own software. However, programming for most owners will prove to be a

difficult task and lead to a great deal of frustration. Remember each job requires a specific set of instructions. As a result, most farmers will likely purchase software that will do "as is" or need minor modification. The difficulty with farmers doing their own programming is two-fold: (1) learning a new language and (2) the great amount of time required. The latter causes more difficulty. What is the farmer going to discontinue (milking, plowing, planting, harvesting, marketing, etc.) so the language can be learned and the programs written?

Several questions need to be examined when considering the purchase of software packages.

1. Is the program compatible with the hardware available (i.e. will it run on my system)?
2. Is the program well documented to the extent that its logic is easily understood and its applicability apparent?
3. Does it have a warranty period that guarantees the supplier will "stand behind" it or fix any bugs for a period of six months or so?
4. Can the program be modified and will the company provide assistance in doing so? It is unlikely that a program will be exactly the way a user wants it when it is first located.
5. Software ownership and copyright policy is important. Can a farmer lend or sell the program to neighbors? What about after a farmer modifies it?

6. Will updated versions be available at zero or low cost if laws or data in the program change? This is important. Just think about the implications of recent tax law changes on farm software packages.
7. Will the company provide a trial-use period to determine if the software really does what it is supposed to do and to find out if it is what is really needed?
8. Is there a list of satisfied users that can tell the buyer about their experience of using the program?
9. Does the software supplier teach you how to use the program? Such service is invaluable.

THE DECISION TO BUY

Remember, the hardware decision is dependent on the software decision. Application software will get better, simpler, and less expensive. This may mean that purchase should be delayed. However, with the present possibilities one may decide to buy based on the idea that adequate software is available and that available hardware will not be obsolete in two years. Important to this decision is to recognize (much to the chagrin of the salespeople) that a microcomputer is not likely to be a great "time-saver." The farm family will be as busy as ever. More time will be available to analyze results because less time will be spent in adding up the numbers. The real benefit comes from having more and better information for decision-making. How a manager generates and uses this information will determine whether the microcomputer is a good or poor investment.

Regardless of the system selected expect more than a little frustration. Its innovations are a challenge and working out the bugs is exciting, a microcomputer will likely be a good investment. If you want a "bug-free" system, the purchase should be delayed. The microcomputer can be a powerful and useful tool in managing the farm business. Its time is here. One last word of caution and encouragement is in order. A microcomputer <u>will</u> make a poorly managed business worse off and <u>can</u> make a well managed business better off.

Computer Jargon and Buzz Words

ADDRESS: A number specifying where a unit of information is stored in the computer's memory.

ASSEMBLY LANGUAGE: Programming language using groups of letters; each group represents a single instruction.

BASIC: (Beginner's All-purpose Symbolic Instruction Code). A relatively easy-to-use computer language that comes with many small and personal computer systems.

BATCH PROCESSING: Literally, a batch of programs or data which has been accumulated in advance and is processed during a subsequent computer run.

BAUD RATE: The speed at which information is exchanged over communication lines, generally expressed in bits per second.

BINARY: The basis for calculations in all computers, this two-digit numbering system consists of the digits zero and one, in contrast to the ten-digit decimal system.

BIT: The smallest unit of information that the computer recognizes, a bit is represented by the presence or absence of an electronic pulse, zero or one (see binary).

BUG: A fault or error in a computer program.

BYTE: A byte is composed of several bits (usually eight). A byte is used to represent one character (a number or letter) of information.

CHIP: A thin silicon wafer on which electronic components are deposited in the form of integrated circuits. Technologically, the key to the micro-electronic revolution in computers.

COBOL: (COmmon Business-Oriented Language). A high-level programming language widely used in business applications.

COMPUTER PROGRAM: A collection of instructions that together perform a particular function.

COMPILER: A special program that converts a programming language into machine language.

CPU: (Central Processing Unit). The part of the computer that controls the interpretation and execution of the processing instructions.

CRT DISPLAY: (Cathode Ray Tube). A television-like screen which may be used for viewing data program instructions.

DENSITY: A term used to describe the distance between the magnetized spots on a magnetic tape or floppy disk. The higher the density, the more data can be stored on a given tape or disk.

DISK: A revolving plate upon which data and programs are stored.

DISK MEMORY: Memory using rotating disks as its storage element.

FLOPPY DISK: A small, flexible recording surface that looks a lot like a 45 rpm record contained in a protective cover.

FORTRAN: (FORmula TRANslation). A computer language widely used to solve scientific and engineering problems.

HARDWARE: The physical components of the computer processing system, for example, mechanical, magnetic, electrical or electronic devices.

INPUT: The data that are entered into the computer; the act of entering data.

K: Computer shorthand for the quantity 1,024; the term is generally used as a measurement of computer memory capacity.

MACHINE LANGUAGE: The language that each machine understands.

MEMORY: The section of the computer where instructions and data are stored; synonymous with storage.

MICROCOMPUTER: A small computer in which the CPU is an integrated circuit deposited on a silicon chip.

MINICOMPUTER: A computer that is usually larger, more powerful and costlier than a microcomputer but is not comparable to a mainframe in terms of productivity and range of functions.

MODEM: A specialized device used to attach a computer or one of its devices to a communication line, often a telephone.

OPERATING SYSTEM: A series of programs generally provided by the computer manufacturer that perform the computer's basic, most heavily used functions.

OUTPUT: The information generated by the computer.

PERIPHERAL: A device--for example, a CRT or printer--used for storing data, entering it into or retrieving it from the computer system.

PROGRAM: A set of coded instructions directing a computer to perform a particular function.

PROGRAMMING LANGUAGE: A set of words and rules that constitutes a language understood by the computer and operator alike.

SOFTWARE: A general term for computer programs, procedural rules and sometimes the documentation involved in the operation of a computer.

SYSTEM: The computer and all its related components.

WORD: A group of bits that the computer treats as a single word.

WORD LENGTH: A number of bits in a computer word.